

references in the publish print process.

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C37.47 (2000) For High Voltage Current-Limiting Type Distribution Class Fuses and Fuse Disconnecting Switches
- ANSI C57.12.26 (1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller
- ANSI C57.12.28 (1999) Pad-Mounted Equipment - Enclosure Integrity
- ANSI C57.12.29 (1991) Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments
- ANSI C62.11 (1999) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits

ASTM INTERNATIONAL (ASTM)

- ASTM D 877 (2000) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE 386 (1995;R 2001) Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V
- IEEE C57.12.00 (2000) Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers (ANSI/IEEE)
- IEEE C57.12.26 (1992) Transformers - Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High Voltage, (34,500 Grd Y/19, 920 and Below; 2500 kVA and Smaller)
- IEEE C57.12.80 (2002) Standard Terminology for Power and Distribution Transformers
- IEEE C57.12.90 (1999) Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers (ANSI/IEEE)

IEEE Std 62 (1995) Guide for Diagnostic Field Testing of Electric Power Apparatus--Part 1: Oil Filled Power Transformers, Regulators and Reactors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ST 1 (1988) Specialty Transformers (Except General Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD 595 (Rev B) Colors Used in Government Procurement

UNDERWRITERS LABORATORIES (UL)

UL 506 (2002) Specialty Transformers

1.2 GENERAL REQUIREMENTS

NOTE: If Section 26 00 00.00 40 GENERAL ELECTRICAL PROVISIONS is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.

NASA Section 26 00 00.00 40 GENERAL ELECTRICAL PROVISIONS applies to work specified in this section.

Certification of previous tests on similar units under actual conditions may be submitted for impulse tests, temperature rise tests, sound tests, power-factor tests, bushing tests, and short-circuit tests in lieu of factory tests on actual units furnished.

Equipment and performance data shall be submitted for distribution transformers including resistance measurements, impedance, and voltage and load losses at rated currents and comply with the applicable provisions of NEMA ST 1, and IEEE C57.12.26.

Equipment foundation data for distribution transformers shall include plan dimensions of foundations and relative elevations, equipment weight and operating loads, horizontal and vertical loads, horizontal and vertical clearances for installation, and size and location of anchor bolts.

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality

control. Include a columnar list of appropriate products and tests beneath each submittal description.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy, Air Force, and NASA projects.

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

The following shall be submitted for distribution transformers:

Connection Diagrams
Fabrication Drawings
Installation Drawings

1.4 FACTORY TESTING

Tests on transformers shall comprise the manufacturer's standard tests including resistance measurements of all windings; ratio tests; polarity and phase-relation tests; no-load loss at rated voltage; impedance; voltage and load loss at rated current; insulation power factor (Doble) tests, insulation oil tests, and dielectric tests. For oil-filled units manufacturer shall certify that the oil contains no PCB's and shall affix a label to that effect on the transformer tank and on each oil drum containing the insulating oil.

1.5 DRAWINGS

Connection diagrams shall be submitted for distribution transformers indicating the relations and connections of devices and apparatus by

showing the general physical layout of all controls, the interconnection of one system or portion of system with another, and internal tubing, wiring, and other devices.

[Fabrication drawings](#) shall be submitted for distribution transformers consisting of fabrication and assembly details to be performed in the factory.

[Installation drawings](#) shall be submitted for distribution transformers in accordance with the paragraph entitled, "Installation," of this section.

PART 2 PRODUCTS

2.1 EQUIPMENT STANDARDS

2.1.1 Pad-Mounted Liquid-Filled Dead Front, Loop Feed Distribution Transformers

Pad-mounted liquid-filled distribution transformers with primary connections to underground high-voltage lines and secondary connections to underground low-voltage distribution feeder circuits shall be two-winding, three-phase, voltage and kVA as indicated, 60-hertz, oil-immersed, 65-degree C rise, self-cooled, Class KNAN, outdoor type, conforming to [ANSI C57.12.26](#), [IEEE C57.12.00](#), [IEEE C57.12.80](#), and [IEEE C57.12.90](#). Three-phase pad-mounted transformers shall be delta/wye connected. Winding shall be copper. Comply with the applicable provisions of [NFPA 70](#).

2.1.2 High Voltage

High-voltage compartment shall contain the incoming line, three insulated high-voltage load-break connectors with bushing well inserts, six high-voltage bushing wells, three surge arresters, access to oil-immersed bayonet fuses, tap changer handle, connector parking stands with insulated standoff bushings, protective caps, and ground bus. Comply with the applicable provisions of [NFPA 70](#).

- a. Insulated high-voltage load-break connectors: [IEEE 386](#), rated 15kV, 95 kV BIL. Connector shall be equipped with grounding tab, test point, and pulling eye.
- b. The transformer primary shall include a loadbreak bayonet fuse addemibly with a flapper valve to minimize oil spillage. Overcurrent protection shall be provided by a bayonet expulsion fuse mounted in series with a partial range under-oil ELSP current-limiting fuse with an interrupting rating of 50,000 A. Bayonet fuse shall sense both overcurrent and high oil temperature in order to provide thermal protection to the transformer. Oil-immersed current-limiting fuses: [ANSI C37.47](#); 150kV BIL; 50,000 amperes symmetrical interrupting rating.

The transformer shall be provided with six (6) high voltage bushings rated for full three-phase duty for loop feed configurations in a radial feed application.

- c. Surge arresters: Primary overvoltage protection shall be provided by externally mounted, heavy-duty distribution class M.O.V.E. deadfront elbow arresters conforming to [ANSI C62.11](#), rated 10kV, fully shielded, dead-front, metal-oxide-varister, elbow type with resistance-graded gap, suitable for plugging into bushing well

inserts. Provide three arresters for radial feed application.

2.1.3 Low Voltage

Low-voltage compartment shall contain low-voltage bushings with copper spade terminals for service lugs, accessories, stainless steel diagrammatic transformer nameplate, and ground bus.

- a. Accessories shall include drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator.
- b. The low-voltage bushings shall be molded epoxy, and provided with 8-hole blade-type space terminals with ANSI standard hole spacing arranged for vertical take-off. The low voltage neutral shall be an insulated X0 bushing, grounded to the tank by a removable ground strap. Comply with the applicable provisions of [NFPA 70](#).

2.1.4 Transformer

- a. Oil-insulated, two winding, 60 hertz, self-cooled type. The average winding temperature rise above ambient temperature, when tested at the transformer rating, shall not exceed 65 degree C.
- b. Transformer shall be rated 500 kVA, 95 kV BIL.
- c. Transformer voltage ratings:

Primary	13.2 kV
Secondary	208Y/120V
- d. Entire transformer (tank, base sill and cabinet) shall be stainless steel. All tank fittings and hardware shall be stainless steel. The top cover shall be welded. Fastenings shall be tamper proof. The pad-mounted equipment shall meet the requirements for tamper resistance set forth in [ANSI C57.12.28](#), including but not limited to the pry test, pull test and wire probe test. Lifting lugs and jacking pads will be provided. Transformer shall conform to [ANSI C57.12.28](#) and [NFPA 70](#).
- e. Tap changer shall be externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Tap changers shall clearly indicate which tap setting is in use.
- f. Minimum tested impedance shall not be less than 4.50 percent.
- g. Audible sound levels shall comply with the following:

<u>kVA</u>	<u>DECIBELS (MAX)</u>
75	51
112.5	55
150	55
225	55
300	55
500	56
750	57
1000	58

<u>kVA</u>	<u>DECIBELS (MAX)</u>
1500	60

- h. Transformer shall include lifting lugs and provisions for jacking under base. The transformer base construction shall be of the fabricated type and suitable for using rollers or skidding in any direction. Provide transformer top with an access handhole. Transformer shall have its kVA rating conspicuously displayed on its enclosure.

2.1.5 Insulating Fluid (Non-PCB)

The dielectric coolant shall be listed, Factory Mutual approved (Approval Standard 3990) and UL Classified "Less-Flammable" per NEC Article 450.

2.1.6 EQUIPMENT FINISH

The transformers shall have the manufacturer's standard finish for highly corrosive areas. The finish shall meet the requirements of ANSI C57.12.29 and shall be No. 7GY3.29/1.5 Munsell Green in accordance with FED-STD 595.

PART 3 EXECUTION

3.1 INSTALLATION

Pad-mounted distribution transformers shall be installed and secured on concrete pads and shall be grounded to a ground grid.

Each pad-mounted distribution shall have its kVA rating conspicuously displayed in 3-inch 75 millimeter high yellow letters on its tank or enclosure in addition to the complete manufacturer's standard identification plate.

3.2 FIELD TESTING

3.2.1 Insulating Liquid Dielectric Test

Transformers shall have the insulating liquid dielectrically tested after installation and before being energized. Insulating liquid shall be tested in accordance with ASTM D 877, IEEE Std 62, and breakdown voltage shall be not less than 25,000 volts.

3.2.2 Insulation Resistance Tests

Transformer windings shall be given an insulation-resistance test using the following test set versus voltage level criteria:

Liquid type 15-to 5-kilovolt transformers - 2,500-volt test set (primary)

Tests shall be applied for not less than 5 minutes and until three equal consecutive readings, 1 minute apart, are obtained. Readings shall be recorded every 30 seconds during the first 2 minutes and every minute thereafter. Minimum acceptable resistance shall be 100 megohms for pad transformers only.

Readings shall be recorded every 15 seconds for the first minute and every minute thereafter for 10 minutes. Resistance between phase conductors and

ground shall be no less than the following:

Liquid type 5 to 15 KV

125 megaohms

3.2.3 Insulation Power Factor (Doble) Tests

Transformer windings shall be given an insulation power factor test and winding excitation test in accordance with ANSI IEEE C57.12.90. Insulation power factor shall not exceed 0.5 percent for new liquid filled units. New dry type units can have power factors up to 5.0 percent and still be acceptable.

3.2.4 Acceptance

Final acceptance shall depend upon the successful performance of the equipment under test. Transformers shall not be energized until recorded test data have been approved by the SGS Subcontract Administrator. Final test reports shall be provided to the SGS Subcontract Administrator

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